ASEAN J. Sci. Technol. Dev., **32(1)**: 16 – 30

Methanolysis of Crude Jatropha Oil using Heterogeneous Catalyst from the Seashells and Eggshells as Green Biodiesel

A. N. R. REDDY[1], A. S. AHMED[1]*, M. D. ISLAM[2] AND S. HAMDAN[1]

In this work, heterogeneous calcium oxide catalysts gleaned from *Polymedosa expansa* and eggshell were investigated for the transesterification of crude jatropha oil with methanol, to access their prospective performance in biodiesel production as an alternative green energy resource. The best yield of biodiesel achieved was 96% in 1 h for *Step 1* using 0.01:1 ratio of acid catalyst to oil and 0.6:1 ratio of alcohol to oil ratio, together with 2 h of *Step 2* using 0.02:1 ratio with base catalyst CaO, derived from *P. expansa*, to oil ratio and 5:1 ratio of alcohol to oil. The properties of jatropha biodiesel were analyzed and found to have calorific value of 35.43 MJ/kg, density value of 895 kg/m^3 and flash point of 167. The biodiesel was blended with mineral diesel from B0 to B50 for a diesel engine performance test. B20 indicated comparable characteristics with pure mineral diesel, like lowest fuel consumption rate, specific fuel consumption rate, highest brake horsepower and mechanical efficiency.

Key words: Biodiesel; jatropha; heterogeneous catalyst; transesterification; alternative green energy resource

Due to increase in the prices of petroleum, gradual depletion of the world's petroleum reserves and impact of environmental pollution caused by combustion of fossil fuel, the search for substantial alternative energy resources such as biodiesel has gained importance (Lippke *et al.* 2011). As reported in the role of biodiesels beyond 2020 (Cluzel 2013) biodiesel has imperative role in the energy sector. Compared to the conventional petroleum diesel, biodiesel is renewable, non-toxic, non-flammable, have low pollutant emissions and safe for use in all conventional diesel engines which has the same performance and engine durability. Srithar *et al.* (2014) and many researchers reported biodiesel can be used alone or can be blended with any ratio of mineral diesel to produce biodiesel blend. The blending of biodiesel with petroleum diesel depicts similar characteristics with lower hazardous exhaust emissions compare to the emission of fossil fuel (Koh *et al.* 2011).

Biodiesel is a green energy resource, compromises mono alkyl ester of long fatty acids derived from biologically produced oils or fats including vegetable oils, animal fats and microalgae oils (Qien *et al.* 2010). Initially many researchers and some developing countries are using edible oils such as rapeseed, soybean, palm, sunflower, coconut, and linseed oils as feedstock for commercial produce of biodiesel (Demirbas 2009; Gui *et al.* 2008).

[1] Department of Mechanical Engineering, Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
[2] Department of Chemistry, Faculty of Science, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia
* Corresponding author (e-mail: aasaleh@feng.unimas.my)